



Research, Development and Technology Division Update

The Research, Development and Technology Division became functional on April 1, 1996. Since that time, the Division has began implementation of strategies to insure that innovative ideas and technology response to the needs of Missouri's transportation system while insuring and maintaining a quality research emphasis. The Division recognizes that research, development and technology transfer is necessary to expand and advance our knowledge in all areas of transportation so that we may provide the best total transportation system for Missourians.

Sharing of ideas and exchange of information is essential to facilitate successful working relationships among our employees, customers, and stakeholders. The Division desires to respond to its customers needs as one of its main goals and to be committed to providing a program that satisfies demands of its customers. By emphasizing a combined and coordinated effort among individuals the Division hopes to maximize ability and productivity while addressing our strategic issues.

Accomplishments to date include:

- Organizational structure has been established that divides the Division into four functions—Administrative, Research, Development, and Technology Transfer.
- Organizational structure will encompass the implementation of SHRP technology operations of the Department.
- Personnel are in place to emphasize and promote the benefits of improved operations in the Department.
- Staff is in place that will be dedicated to new product evaluation.
- Personnel are in place to participate in committees as Missouri cooperates in the concept of three SHRP technologies (High Performance Concrete, Assessment of Physical Condition of Concrete Bridge Components, Removal, Repair and Protection and Rehabilitation of Reinforced Concrete Structures)
- Division personnel hosted and attended an NHI training course

for PEER Exchange. A PEER Exchange Review, MoDOT's RDT Division is planned to be completed prior to October 1, 1997.

- RDT personnel meeting with Management Teams of all Districts and Divisions for informational exchange and to lay the groundwork for cooperatively working together in the future.

- Technical Review Committee members have been noted for each division and districts within the Department. An organizational meeting for the Technical Review Committee was held November 13, 1996.

- RDT personnel host SHRP Showcase for "Assessment of Physical Condition of Concrete Bridge Components" and "Removal, Repair and Protection, and Rehabilitation of Reinforced Concrete Structure" in the spring of 1997. On the following page is a list of the Technical Review Committee members for each district, division and office for future reference.

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Technical Review Committee (TRC)

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Intelligent Transportation Systems Update

Intelligent Transportation Systems technology is developing rapidly and successful deployment of new technology will lead the way for benefits to improve transportation and traffic efficiency. Missouri DOT is involved in several themes that address various ITS issues. The following is a brief summary of the areas of involvement.

Major Metropolitan Areas

St. Louis - An ITS Early Deployment Study for the St. Louis area was completed in April 1994 and a Strategic Deployment Plan was included as part of the final report. Initial elements of the strategic plan are currently being implemented under the guidance of an Incident Management Coalition which was organized in 1993. The first project includes expansion of the Motorist Assist Program (freeway service patrol), establishment of a cellular call-in system, a roadway reference marking system, an improved communication system between MoDOT and local jurisdictions, and operation assistance for a Traffic Information Center. Design Contracts are also underway for the development of the TIC and operational software for the ITS system. This work is being undertaken in phases and has a total estimated cost in excess of \$12 million with 80% Federal-aid participation in CMAQ funds. To date \$3.0 million in CMAQ funding has been obligated.

Kansas City - In order to assess transportation needs and identify user services for implementation, an ITS Early Deployment Study was completed in February 1996 for the Kansas City area. This study produced a Strategic Deployment Plan which documents the transportation system characteristics in the Kansas City metropolitan area, ITS user services appropriate for application, a system architecture, alternative technologies available, and an implementing plan. The study also addressed coordination with local jurisdictions and integration with existing transportation and communication systems. The study was jointly funded by the Kansas Department of Transportation (KDOT) and the Missouri Department of Transportation (MoDOT). Coordination efforts between KDOT and MoDOT are continuing for initial implementation of ITS elements in the Kansas City area. The FY97 appropriations bill included \$2.5 million in additional funding for Kansas City which will help to implement phase I of the ITS Strategic Deployment Plan.

ITS Innovative Finance Project

MoDOT is proceeding with implementation of a statewide Intelligent Transportation System and installation of the fiber optic communications network under the public-private partnership with Digital Teleport, Inc. Approximately 500 miles of the 1700 mile fiber optic system has been installed. The value of the fiber optic system has been recognized under the FHWA Innovative Finance program and a \$30 million soft match credit was approved by Administrator Slater on October 23, 1995, for use on future ITS projects. To date, \$593,196 of the soft match has

been utilized to help advance ITS projects in Missouri.

Wireless Telecommunications

Because of its leadership position in the use of highway ROW for placement of fiber optic telecommunications, MoDOT has also recognized the developing market for wireless systems and has initiated action to position itself to take advantage of the new technology. MoDOT has a contract underway with Apogee Research, Inc., to assist in the development of a policy for the installation of wireless telecommunication devices on highway ROW. The consultant has submitted a draft Policy on Wireless Telecommunications which identifies pertinent issues, describes alternative approaches for each, and makes recommendations for developing public-private partnerships. This information will guide MoDOT management in its decision making process concerning adoption and implementation of a wireless telecommunications policy. This effort is scheduled to be completed by the end of 1996.

Commercial Vehicle Operations

ITS/CVO Mainstreaming Program

Agreement has been reached between MoDOT and FHWA for Missouri to participate in the ITS/CVO Mainstreaming program as the lead state. Additional ITS funds, including \$181,316 for Mainstreaming activities and \$52,000 for Institutional Issues Phase II activities, have been provided to support the MoDOT workplan which will facilitate deployment of an electronic clearance system for commercial vehicles in Missouri. The

Mainstreaming program will include development of a strategic business plan for each state participating in a Regional consortium which will provide a foundation to facilitate nationwide deployment.

Operational Test - Multi-State One Stop Electronic Purchase of Motor Carrier Credentials

This project involves designing and beta testing a simple, lowcost, and easily deployed one-stop electronic service system which will allow motor carriers to receive all the necessary credentials or permits electronically from a base State or other individual States. The operational test will include six motor carrier firms and the State of Minnesota working with Missouri. Initiation of the operational testing has been delayed until March 1997 to make further revisions to the software package being developed and to complete the related training materials.

ITS Rural Workshop

In a cooperative effort between FHWA, the Mid-America Transportation Center, the Missouri Technology Transfer Center and MoDOT, an ITS Rural Workshop was held on August 1, 1996. This was part of a regional activity which conducted a workshop in each Region 7 state. The purpose of the workshop was to gather representatives of various public and private agencies and provide a forum for discussion of ITS technologies to address rural needs. The workshop was successful in identifying a variety of stakeholders with ITS interests and numerous issues for further discussion. MoDOT will play a key leadership role in directing future ITS rural applications.

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ITS Coordination Team

The Missouri ITS Coordination Team is continuing to provide a forum for interaction and effective communication for planning, development, operational testing, and implementation of ITS program elements in Missouri. Participants in this team include representatives from the Missouri State Highway Patrol, Missouri Department of Revenue, and Missouri Motor Carrier Association and all of the various MoDOT sections currently involved in ITS development or implementation. The ITS Coordination Team has proven especially useful in coordinating ITS/CVO activities and provided assistance in reaching agreement with MoDOT to serve as lead state in the Mainstreaming Program. The Team has also been recognized by the FHWA Region office as a model and has been recommended for implementation in other Region 7 states.

Innovative Electronic Advanced Warning System

An Innovative Electronic Advanced Warning System is located on Route 54 south of Camdenton on the Niangua Bridge. This bridge carries an average daily traffic of approximately 8,000 vehicles, 7% of which are trucks and has a deck width of twenty feet. Upon field investigations, the following situations were encountered.

- Drivers stopping at the bridge if a

large vehicle was crossing, causing rear end accidents

- Drivers near the centerline of the bridge causing side swipe accidents.

- Left turn traffic at lake roads located at the end of the bridge approaches contributing to rear end accidents.

Utilizing the normal traffic control devices to address public concerns about the bridge were inadequate. The District 5 traffic section requested assistance from the Incident Management Specialists to research new products on the market and the latest technology applicable to this situation. Combining several different products to fit the situation, they created the Electronic Advanced Warning System currently in place.

The Electronic Advanced Warning System was designed to warn motorists of large vehicles crossing the bridge in the opposing lane. This message was relayed to the driver by a flasher on top of a "Caution" sign located at both ends of the bridge. Whelen TDN-20 narrow beam microwave units, mounted on a post, were utilized to detect vehicle direction and height. These units were set

to detect approaching vehicle with a minimum height of ten feet.

Radio telemetry was utilized to activate the flasher on the opposite side of the bridge. The signal was projected, via the radio telemetry unit, from the detecting side to the flashing side and then carried by wire to the flasher.

The second part of the Electronic Advanced Warning System was the installation of a "Be Prepared to Stop" sign with a flasher at both ends of the bridge. Using Induction Loop technology, an eighty foot detection zone was created to detect stopped to slow moving traffic. When these criteria were met, then the flasher on the sign begins to flash warning approaching traffic of the condition ahead.

This equipment, although somewhat susceptible to failure from lightning, has worked very effectively. The motorists seem to understand the function of the equipment and heed its warning. It is still too early to make an overall analysis of the effectiveness of the system relating to accidents. However, the traffic section believes this is an effective short term solution with logical expectations and benefits.

(A more complete coverage of this installation is available upon request.)



Motorist's view approaching bridge site.

Priority Technology Program

The National Priority Technologies Program recently solicited projects for fiscal year 1997 funding. Each FHWA Regional Office and Federal Lands Highway Office has approximately \$250,000 to fund projects. The program supports advancement of innovative construction technologies, materials and procedures with the potential to improve durability, environmental impact, safety, efficiency, or productivity. The potential projects that advance application of leading edge (commercialized but underutilized) technologies are especially good candidates. Priority is given to technology that satisfies a clearly defined national need and has potential for cost savings (quick return on investment) through widespread application.

Thirty-three projects were funded in fiscal year 1995. Examples of the types of funded projects include:

- development of traffic surveillance domes,
- anti-skid overlays for bridge decks,
- fiber reinforced plastics for seismic retrofit of bridges,
- waste re-use in construction.

Examples of types of projects Region 7 funded during fiscal year 1996 include:

- video traffic accident investigation,
- early warning systems for motorists during construction,
- asphalt pavement thickness measurement using non-destructive GPR,
- transportation planning GIS, and
- fiber reinforced composite beam

for maintenance.

MoDOT has initiated several concept statements for priority technology program projects for fiscal year 1997. These concept statements will be used to select projects to go forward to the second stage of work plan development. The top projects will be approved based on funding availability and subject to an approved evaluation/workplan including a task budget. Concept statements for fiscal year 1997 submitted by MoDOT are as follows:

A. Proposed Fog Detection System for Missouri locations. A fiber optics sensing method will be used to detect visibility. The results will be displayed on a message billboard to alert traveling public of hazards. Vehicle speeds will be monitored to see if the warning board has enhanced safety.

B. A proposal to add pavement temperature sensors to existing traffic data collection sites for use as road weather information sites. Additional pavement condition information gathered may include temperature, moisture, and chemical concentration data for the present sites. Primary benefits will include maximizing maintenance personnel, performance and efficiency in snow and ice control efforts. Secondary benefits will be possible expansion of MoDOT's ITS Rural Weather Information System to the traveling public

along with temperature and moisture data for use in future pavement design.

C. Ground Penetrating Radar (GPR) interpretation technology developed through the Strategic Highway Research Program will be used to non-destructively determine pavement thickness of portland cement concrete pavement. This new tool could be utilized for quality control/quality assurance when considering specifications concerning pavement items.

D. Develop and accelerate implementation of liquid emitting diode (LED) signal head technology to provide more cost efficient and longer life system which provides a higher intensity signal head and is more readily discernible to motorists.

Evaluation of an LED installation is proposed at a yet to be awarded installation site.

Special emphasis is being made in Region 7 to select projects that quantify the benefits in dollars as part of the evaluation plan. Other criteria for selection include the extent funds are leveraged by other sources and the number of partnerships involved with emphasis on partnerships with private industry.

(Complete concept statement proposals are available upon request for any of the above 1997 projects.)

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Success Story:

JACKSON COUNTY LOW-VOLUME ROAD PAVEMENT MANAGEMENT SYSTEM

Most agencies today, use the same PMS for two lane low-volume roads with a low average daily traffic (ADT) as they do for major roads, (Expressways or Major Arterial) with high average daily traffic; even though these road types have different functional classifications, road characteristics, distresses and sometimes even different types of pavement surfaces.

Investigation of existing literature, however, reveals that most of the existing PMS available today are developed for flexible and rigid pavements. We would not find a system for low-volume and built-up roads. Unfortunately, some pavement management systems can not be used directly by local governments because of the vast differences in the (1) pavement types such as flexible, chip seal, cold mix and gravel, (2) roadway functional classification, (3) budget, (4) personnel skill, (5) construction technique and availability of material, (6) equipment type, (7) type of daily maintenance, (8) agency size, and other environmental conditions. Therefore, a decision was made to develop a customized system based on methodologies, techniques, and resources, that are consistent with local circumstances. Experience from other authors was used in selecting the concept and framework of PMS development. Several systems were analyzed and special attention was given to the methods and means already available. Pavement management had been

carried out for several years using a certain methodology and particular means, and for this reason it was decided to take maximum advantage of this information whenever possible.

The new LVR-PMS™ method includes the distress types, condition survey techniques, and maintenance decision trees for various pavement types, (flexible, chip seal, cold mix and gravel). Next, a repair/rehabilitation plan is described which includes: the agency's size and budget, roadway characteristics and performance, roadway functional classification, traffic volume, maintenance and construction procedures, availability of material and construction equipment, operation cost of vehicles, construction staging, and salvage value of existing roadway material.

JACKSON COUNTY BENEFITS

Five years ago, Jackson County, did not have information on the condition of the roadway network. They allocated their budget based on "Worst First" basis. The roads that look bad get the attention. They did not have a routine maintenance plan to extend the service life of a roadway pavement. Dr. Ali Roohanirad in Jackson County, Missouri, recognized the way pavements generally deteriorate. During the first seventy-five percent of pavement's life, it performs well and, representing level of service A through D (level of service A, represents a pavement with excellent condition and level of service D, represent a pavement with fair condition). After that, however, the pavement deteriorates so rapidly it seems to fall apart. The number of years that a pavement stays in good condition depends on how well it

is maintained. Ideally, pavement life could be extended indefinitely with the proper timing of pavement rehabilitation and good interim maintenance. \$1 for maintenance when pavement is in fair to good condition (\$11,000 per mile for two lane roadway) will cost \$6 to \$8 for reconstruction (\$66,000 to \$88,000 per mile for two lane roadway) if delayed to failed condition. LVR-PMS™ will help Jackson County save more than \$200,000 every year by performing the correct (most economically) yearly maintenance procedures on roads that actually are in need of maintenance, or maintaining a road before failure.

Other Jackson County benefits associated with using LVR-PMS™ include:

1. Evaluation of projects by use of objective data
2. Custom developed programs to fit Jackson County needs
3. Immediate access to geometric, condition and historical data
4. Use of objective data to: (a) evaluate projects, (b) describe current condition of network, (c) target rehabilitation actions
5. Quick and efficient analysis of objective data for: planning, scheduling, resource allocations, and budgeting.
6. Elimination of duplication of effort
7. Improving overall performance level (measured by PCI)
8. Establish short and long term budgetary requirements (predict future pavement condition)
9. Comprehensive assessment of current status of network
10. Objectively based answers to:

("Success Story ...", continued)

- (a) what level of funding required to keep current status, or
 - (b) when, where, and how to spend budgets
 - (c) how much money is needed
11. Able to back up or justify capital and maintenance program to legislature
 12. Assurance that program represents best use of available dollars
 13. Able to assign priorities on objective basis under limited funding

SUMMARY:

Some of the items that help Jackson County to improve roadway pavement conditions reduce maintenance costs, and extending the service life of the pavement include:

1. Availability of sound and objective pavement condition index data.
2. Being able to plan, schedule, and prioritize road improvement programs.
3. Perform correct and most cost effective yearly routine, preventive, rehabilitation, and

reconstruction maintenance procedures on roads that actually are in need of maintenance, before failure.

(Article provided by Dr. Ali Roohanirad, Jackson County P.W. (816) 881-4530. See Training Workshop available by request.)

Support for new highway technologies

In 1994, FHWA announced a new program to support new highway technologies. The Applied Research and Technology (ART) Program allows for accelerated testing and evaluations of new technologies to improve both the physical condition and operation of highways and bridges.

Assistance will be provided by the American Society of Civil Engineers' HITEC* program administrators.

Proposals for evaluation of projects requesting ART Program funding are invited from anyone—private or public. Proposals are sent to HITEC, which will process applications. HITEC will act as the

clearinghouse for new technologies from the public and private sources. Public agencies should encourage private companies or individuals to submit their "innovative" technologies, including proprietary products, to HITEC for screening and possible evaluation. HITEC will develop an evaluation procedure with the assistance from the public sector. Hence, the plan for evaluation will be forwarded to FHWA for possible funding under ART. State highway agencies may submit applications to HITEC for non-commercial technologies.

The ART Program may provide up to 80 percent of funding for installing or constructing new technologies for FHWA approved projects. In addition, the costs for testing, data collection, evaluation, and report preparations associated with the project are eligible for up to 100 percent ART funding.

Funds are available under ART for general research and development

(R&D) or for any technology development costs.

A wide range of technologies are eligible for consideration under ART including the following:

- * Accelerated construction materials and procedures.
- * Materials and procedures that are environmentally beneficial.
- * Materials and procedures that enhance the serviceability and longevity under adverse climates, environments, and loads.
- * Technologies that increase efficiency and productivity of vehicular travel, and
- * Technologies that enhance safety and accessibility of vehicular transportation systems.

For more information on ART, contact HITEC, c/o Civil Engineering Research Foundation, 1015 15th Street NW, Suite 600, Washington, D.C. 20005-2605. Telephone (202) 842-0555, Fax (202) 789-5345.

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Future Events

1997 Herbicide Recertification

(see article)

February 3-6, 1997

Strategic Highway Research Program (SHRP) Showcase
Crown Plaza Hotel

Kansas City, Missouri
Contact: Glen Faulkerson
Phone: (573) 636-7104

February 25, 1997

Herbicide Training
Holiday Inn Executive Center
Columbia, Missouri
Registration: (573) 751-0852

March 4-6, 1997

American Traffic Safety Services
Association (ATSSA) Certification

Program

Kansas City, Missouri
(see training course registration
form)

April 27-30, 1997

APWA - North American Snow
Conference
Kansas City, Missouri

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